

## 2012 ANTIBIOGRAM FOR SELECTED BACTERIA OF PUBLIC HEALTH AND CLINICAL SIGNIFICANCE: ISOLATES COLLECTED BY CLINICAL LABORATORIES IN MONTANA

The Montana Department of Public Health and Human Services monitors antimicrobial susceptibility testing (AST) and has provided a statewide antibiogram annually since 2005. For the 2012 analyses, AST data were collected from 26 laboratories (red pins with black dots on map) and over 40,000 isolates were tested throughout the state. Data from each participating laboratory are compiled to create a statewide antibiogram using the methodology described by the Clinical and Laboratory Standards Institute (CLSI)<sup>1</sup>. Data are presented as the mean  $\pm$  standard error of the mean (SEM) and variability is also assessed through the calculation of a coefficient of variation (CV). When the CV exceeds 20% it is annotated on the antibiogram and can be due to a single outlier, low sample number, or significant differences amongst values reported by each facility. The utilization of CLSI performance standards (M100 Table) is paramount to successful antimicrobial identification and guidance of treatment<sup>2</sup>. Most variability in the 2012 AST data could be attributed to facility-dependent factors such as patient population. There are other instances of improbable results that include: 46 isolates of *K. pneumoniae* reported as ampicillin-susceptible, 244 isolates of *P. aeruginosa* reported as cefepime-resistant, continued reporting of penicillin susceptibility for methicillin-resistant *S. aureus* (MRSA) isolates, and 23 isolates of methicillin-susceptible *S. aureus* (MSSA) reported as *not* susceptible to oxacillin (likely a clerical error).

The present analyses include the reporting of resistant organisms of major public health significance. Of the isolates reported for the *Enterobacteriaceae* family (*E. coli*, *K. pneumoniae*, *Enterobacter spp.*), 183 (0.4%) were not susceptible to carbapenems. Only 82 potentially resistant isolates had been submitted to the MT Public Health Laboratory (PHL) for confirmation. Of these, only 15 isolates were positive using the modified Hodge test. Carbapenem-resistant *Enterobacteriaceae* (CRE) are categorized as “urgent threats” in a recently published CDC document<sup>3</sup>, and every one of these isolates should be forwarded to the MT PHL. Another finding was the reporting of isolates of the *Enterococcus* species as not susceptible to vancomycin. Of isolates differentiated and reported as *E. faecalis* or *E. faecium*, 110 (4% of total tested; down from 6% in 2011) were reported as not susceptible to vancomycin. The aforementioned CDC report lists these organisms as “serious threats”, with vancomycin-resistant *Enterococcus* (VRE)-associated illness causing more than 1000 deaths per year in the U.S.

Over 2000 isolates are designated as MRSA for 2012 (33% of all *S. aureus* isolates differentiated as MRSA or MSSA), numbers that are roughly equal to those found in the 2011 analyses. Over twice that number of isolates (>4000) are reported as MSSA; however, 2 of these isolates are reported as not susceptible to vancomycin (i.e. VISA and VRSA). This is a significant decrease from the 2011 report, where a dozen unconfirmed VISA/VRSA isolates were reported. This change may have been due to a true decrease in the number of VISA/VRSA reported or, more than likely, due to absence of data from those laboratories which reported in 2011 but not in 2012.

According to MT PHL 2012 records, VISA/VRSA isolates from three separate patients were submitted for confirmation. Of these, one was VISA/VRSA negative (also MRSA negative), two were VISA positive by E-test, and one was referred to the CDC. Broth microdilution did not confirm VISA in this case. VISA/VRSA have been designated “concerning threats” and, although their incidence may be low, the infections prove extremely difficult to treat. Please note that, under the updated rules in the Laboratory Reporting of Communicable Diseases in Montana<sup>4</sup>, all suspected or confirmed isolates of CRE and VISA/VRSA *must* be submitted to the state Public Health Laboratory for confirmation and further characterization.



		penicillins										cephems				macrolides					quinolones									
Gram Positive Isolates	# of isolates (all sources)	Penicillin	Ampicillin	Oxacillin	Trimethoprim-Sulfamethoxazole	Rifampin	Vancomycin	Tetracycline	Linezolid	Daptomycin	Meropenem	Cefotaxime	Ceftriaxone	Levofloxacin	# of isolates (non-urine)	Azithro, Clarithro, or Erythromycin	Clindamycin	Erythromycin	# of isolates (urine only)	Ciprofloxacin	Levofloxacin	Norfloxacin	Nitrofurantoin	Tetracycline						
<i>S. aureus (non-differentiated)</i>	2160	898 11.7 ± 4.1		1999 59.7 ± 4.0	2139 99.2 ± 0.3	2139 99.1 ± 0.5	2139 99.9 ± 0.1	2160 94.8 ± 0.8	1981 95.9 ± 3.2	781 99.3 ± 0.7*					791	583 40.4 ± 10.4*	791 83.6 ± 4.3	341 39.5 ± 4.5*	109				109 99.3 ± 0.7							
<i>S. aureus (MRSA)</i>	2018	505 0.0		1509 7.7 ± 7.7	1530 98.9 ± 0.4	1520 98.9 ± 0.3	1686 98.8 ± 0.2	1588 91.0 ± 3.2	1885 98.5 ± 1.0	85 98.5 ± 1.5*					322	102 18.2 ± 12.3*	322 67.4 ± 9.3*	315 23.0 ± 14.7*	54				52 85.5 ± 14.5*							
<i>S. aureus (MSSA)</i>	4132	2091 22.2 ± 3.1		3739 99.6 ± 0.4	4121 98.1 ± 0.7	3735 98.4 ± 0.7	4121 100.0 ± 0.0	3734 95.6 ± 0.6	3833 98.5 ± 1.4	229 100.0 ± 0.0*					1036	57 53.7 ± 6.3*	947 75.9 ± 5.5	1033 61.0 ± 3.4	76				62 97.7 ± 2.3*							
<i>S. pneumoniae</i>	411	258 59.5 ± 7.8			185 81.3 ± 7.2		392 100.0 ± 0.0	392 85.2 ± 2.7			107 90.8 ± 3.1*	150 97.7 ± 1.2	315 94.4 ± 3.6*	313 98.9 ± 0.9	75			75 58.5 ± 8.9*												
<i>Enterococcus spp.</i>	1004	907 88.8 ± 4.7*	1004 89.7 ± 2.7				997 97.8 ± 1.1		152 100.0 ± 0.0*	55 100.0 ± 0.0*									43	37 90.0 ± 10.0*	37 88.5 ± 2.5*		37 100.0 ± 0.0*							
<i>E. faecalis</i>	2387	1944 97.3 ± 1.1	2295 97.1 ± 1.2				2364 98.5 ± 0.7		2146 94.8 ± 2.1	123 96.3 ± 2.8*									1006	891 65.5 ± 5.2	904 68.3 ± 3.7		976 97.8 ± 1.1	796 28.3 ± 3.2						
<i>E. faecium</i>	192	94 47.6 ± 12.8*	185 45.6 ± 9.1				192 61.8 ± 11.6		160 97.6 ± 1.5*										39	39 46.6 ± 13.5*	39 46.6 ± 13.5*		39 57.2 ± 20.6*	34 57.8 ± 10.4*						
		aminoglycosides			b-lactam/b-lactamase inhibitor			cephems					quinolones		carbapenems			sulfonamide	penicillins				single agents							
Gram Negative Isolates	# of isolates (all sources)	Gentamicin	Tobramycin	Amikacin	Amoxicillin-Clavulanic Acid	Ampicillin-Sulbactam	Piperacillin-Tazobactam	Ticarcillin-Clavulanic Acid	Cefazolin	Cefuroxime	Cefepime	Cefotetan	Cefoxitin	Cefotaxime or Ceftriaxone	Ciprofloxacin	Levofloxacin	Ertapenem	Imipenem	Meropenem	Trimethoprim-Sulfamethoxazole	Piperacillin	Ampicillin	# of isolates urine only	Cephalothin	Norfloxacin	Nitrofurantoin	Sulfisoxazole	Trimethoprim		
<i>E. coli</i>	20251	18577 94.4 ± 0.5	19257 91.5 ± 2.5	12384 99.3 ± 0.4	9279 87.7 ± 1.6	16412 72.0 ± 1.8	9744 96.6 ± 1.2	1875 92.3 ± 2.2	19949 90.5 ± 0.8	3001 87.2 ± 5.7	18069 95.2 ± 1.8	1265 98.8 ± 0.8*	11282 95.0 ± 0.8	16017 94.8 ± 2.4	20177 84.2 ± 1.3	18015 83.3 ± 1.4	14277 99.6 ± 0.2	19904 99.8 ± 0.1	6448 99.8 ± 0.2	19324 81.7 ± 1.2	3219 58.6 ± 4.2	19024 62.1 ± 1.9	9276	1377 69.5 ± 7.4	1067 82.0 ± 8.6*	9270 94.1 ± 0.8		811 82.5 ± 4.4*		
<i>K. pneumoniae</i>	3754	3220 96.9 ± 1.5	3610 96.0 ± 1.9	2206 98.7 ± 0.8	1825 92.2 ± 2.9	2822 85.9 ± 3.8	1541 94.7 ± 1.4	335 96.7 ± 2.1	3405 90.9 ± 2.9	406 89.8 ± 3.8	3540 97.0 ± 0.9	216 98.5 ± 1.5*	1913 90.0 ± 4.5	3392 94.4 ± 2.3	3645 94.1 ± 1.4	3210 95.1 ± 1.5	2707 96.8 ± 2.1	3724 98.2 ± 1.3	1542 98.3 ± 1.1	3603 90.8 ± 2.0	344 38.3 ± 16.3	1887 11.3 ± 6.8	1351	108 86.0 ± 12.1*	57 100*	1049 50.3 ± 5.5		102 84.7 ± 13.9*		
<i>Enterobactor spp.</i>	830	830 97.4 ± 1.7	659 98.7 ± 0.6	669 99.5 ± 0.4	163 22.9 ± 14.6	98 21.8 ± 15.0*	273 87.8 ± 6.2*	62 95.3 ± 4.7*	492 16.3 ± 9.3	115 63.0 ± 15.7	635 99.9 ± 0.1	61 70.3 ± 23.0*	251 15.7 ± 6.6	578 89.1 ± 2.6	830 94.9 ± 2.0	511 94.4 ± 2.5	439 98.7 ± 0.7	830 99.7 ± 0.2	198 100.0 ± 0.0	137 92.7 ± 1.4	830 84.8 ± 3.3*	91 31.6 ± 18.5*	324			316 37.4 ± 6.7				
<i>Serratia spp.</i>	93	91 95.9 ± 4.1	58 95.6 ± 2.7*	75 100.0 ± 0.0							84 100.0 ± 0.0			56 96.0 ± 4.0*	93 91.0 ± 5.0	60 88.3 ± 7.4		93 99.4 ± 0.6		93 92.8 ± 4.8										
<i>P. aeruginosa</i>	2927	2922 87.2 ± 1.6	2837 97.7 ± 0.8	2284 95.9 ± 1.3			1136 96.8 ± 1.4				2819 93.4 ± 1.2				2899 80.7 ± 2.7	2418 76.6 ± 3.0		2899 92.5 ± 1.2	950 95.4 ± 1.9		204 97.5 ± 1.4									
<i>Acinetobactor spp.</i>	46	46 100.0 ± 0.0	36 100.0 ± 0.0*								45 97.3 ± 2.8*			36 27.0 ± 14.6*	46 94.4 ± 5.6	31 100.0 ± 0.0*		45 100.0 ± 0.0*		44 87.5 ± 7.3*										

**2012 Montana Antibiotogram.** Data were collected from January 1 through December 31. The antibiotogram reflects data submitted by 26 clinical laboratories throughout the state (see map). Note: data are presented for surveillance purposes only and should not be used solely in the determination of therapy for individual patients. Number of isolates tested for each drug is displayed in red font; percentage of isolates susceptible to each drug (expressed as mean ± SEM) is shown in black font<sup>5</sup>; \*data from five laboratories or fewer (minimum of two); green square indicates variability in the data set with a coefficient of variation (CV) greater than 20%; gray square indicates either no tests performed or fewer than thirty isolates submitted; orange square indicates a possible reporting error or isolates that are a cause of concern.

- 1) Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data; Approved Guideline-Third Edition. CLSI document M39-A3. Wayne, PA: Clinical and Laboratory Standards Institute; 2009.
- 2) Performance Standards for Antimicrobial Susceptibility Testing; Twenty Second Informational Supplement. CLSI document M100-S23. Wayne, PA: Clinical and Laboratory Standards Institute; 2013.
- 3) Antibiotic Resistance Threats in the United States, 2013. Atlanta, GA: Centers for Disease Control and Prevention; 2013.
- 4) Laboratory Reporting of Communicable Diseases in Montana (June 2013); <http://www.dphhs.mt.gov/publichealth/lab/documents/LABDPHHSDisseaseReportingtoLHJ.pdf>
- 5) Mean ± SEM was calculated using the percent susceptible value submitted by each laboratory for each drug/organism combination. N values (i.e. number of laboratory submittals) ranged from 2 to 26.